ENVIRONMENTAL ASSESSMENT
for the
INTERIM MANAGEMENT PLAN

Elwha River Ecosystem Restoration

Prepared for

National Park Service
Port Angeles, Washington

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January 2000

Environmental Assessment
for the
Interim Management Plan
Elwha River Ecosystem Restoration

Contract 1443CX2605-98-004

Order # 1443TO260599-A08


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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
BOR	Bureau of Reclamation
BPA	Bonneville Power Administration
cfs	cubic feet per second
DNR	Washington Department of Natural Resources
EA	Environmental Assessment
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
Elwha Act	Elwha River Ecosystem and Fisheries Restoration Act
ESA	Endangered Species Act
ESU	Ecologically Significant Unit
gpd	gallons per day
gpm	gallons per minute
GWh	gigawatt hours
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPS	National Park Service
PCB	polychlorinated biphenyl
RM	river mile
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife

1. PURPOSE AND NEED

This chapter discusses the purpose of, and the underlying need for, the interim management plan, which is documented in this Environmental Assessment (EA). In addition, Chapter 1 describes the decision to be made, the scoping activities, and the issues associated with developing the interim management plan. Figure 1-1, located at the end of this chapter, shows the project area and the surrounding lands.

1.1 PURPOSE AND NEED FOR ACTION

Acquisition of the Elwha and Glines Canyon hydroelectric projects, associated lands, and facilities is anticipated to occur in February 2000. The Elwha River Ecosystem and Fisheries Restoration Act (the Elwha Act) authorizes the Secretary of the Interior to acquire the Elwha and Glines Canyon dams and to fully restore the river's ecosystem and native anadromous fisheries. A 1995 Environmental Impact Statement (EIS) concluded that both dams must be removed to meet the goal of the Elwha Act. A 1996 implementation EIS analyzed the alternatives for dam removal, sediment management, water quality protection, revegetation, and fish restoration. A Record of Decision was signed in 1997 to implement the preferred alternative. These documents include a comprehensive analysis of the social, economic, and ecological issues associated with dam removal. This EA is tiered to these documents and the analysis that they contain is incorporated by reference into this EA.

The Elwha Act stipulates that the 160-acre area within the Olympic National Park that is part of the Glines Canyon Project will be managed as part of the Park. The long-term management of the 1,061 acres associated with the Elwha Project that are outside the Park was not stipulated in the Elwha Act. Therefore, the purpose of this EA is to provide an analysis of the alternatives considered for an interim plan for public management of the lands scheduled to become publicly owned through the acquisition of the Elwha Project. The management of these lands is an important issue that will require public input and deliberation. This process cannot be completed before the project becomes publicly owned in early 2000. Therefore, the need for this project is to complete an interim management plan to manage these 1,061 acres until a long-term land manager is identified and an associated management plan is developed and approved. It is imperative that this plan be in place for the protection and public use of these lands until the appropriate long-term management entity has been identified.

The National Environmental Policy Act (NEPA) requires an environmental analysis of any federal action that may have a significant effect on the environment. This environmental analysis analyzes the proposed interim management plan and the alternatives to this plan.

1.2 DECISION TO BE MADE

The deciding official, the Park Superintendent, will decide how the 1,061-acre area associated with the Elwha Project that is outside of the Park boundary will be managed between the time of acquisition and the approval of a long-term management plan for the area. It is important to note that this analysis will not reconsider whether or not to remove the dam, how to manage the sediment, or other environmental or social issues analyzed in previous EISs. These decisions have already been made.

1.3 SCOPING

Information on the issues and concerns that are important to the public was solicited via a scoping letter sent to over 1,200 people and organizations. The National Park Service (NPS) maintains a list of concerned people and organizations that it has developed over the last several years of discussion and study of the future of the Elwha River. The NPS received 52 responses. In addition, an internal scoping meeting was held on September 9, 1999 to identify NPS staff concerns. The Washington Departments of Fish and Wildlife and Natural Resources, Clallam County, and the Lower Elwha Klallam Tribe were also consulted.

Issues identified for this project include:

- **Tribal Rights:** Will the treaty rights of the Lower Elwha Klallam Tribe be affected?
- **Law Enforcement:** Will laws be enforced by NPS employees or by state and county authorities? If NPS employees are involved in law enforcement, what type of jurisdiction will they have?
- **Recreation:** What type of access will the public have for recreation in the project area? Will hunting and fishing be allowed?
- **Dam Management:** Will power continue to be produced at the Elwha Dam during the interim plan? Will the dam be managed for fish protection and recovery?

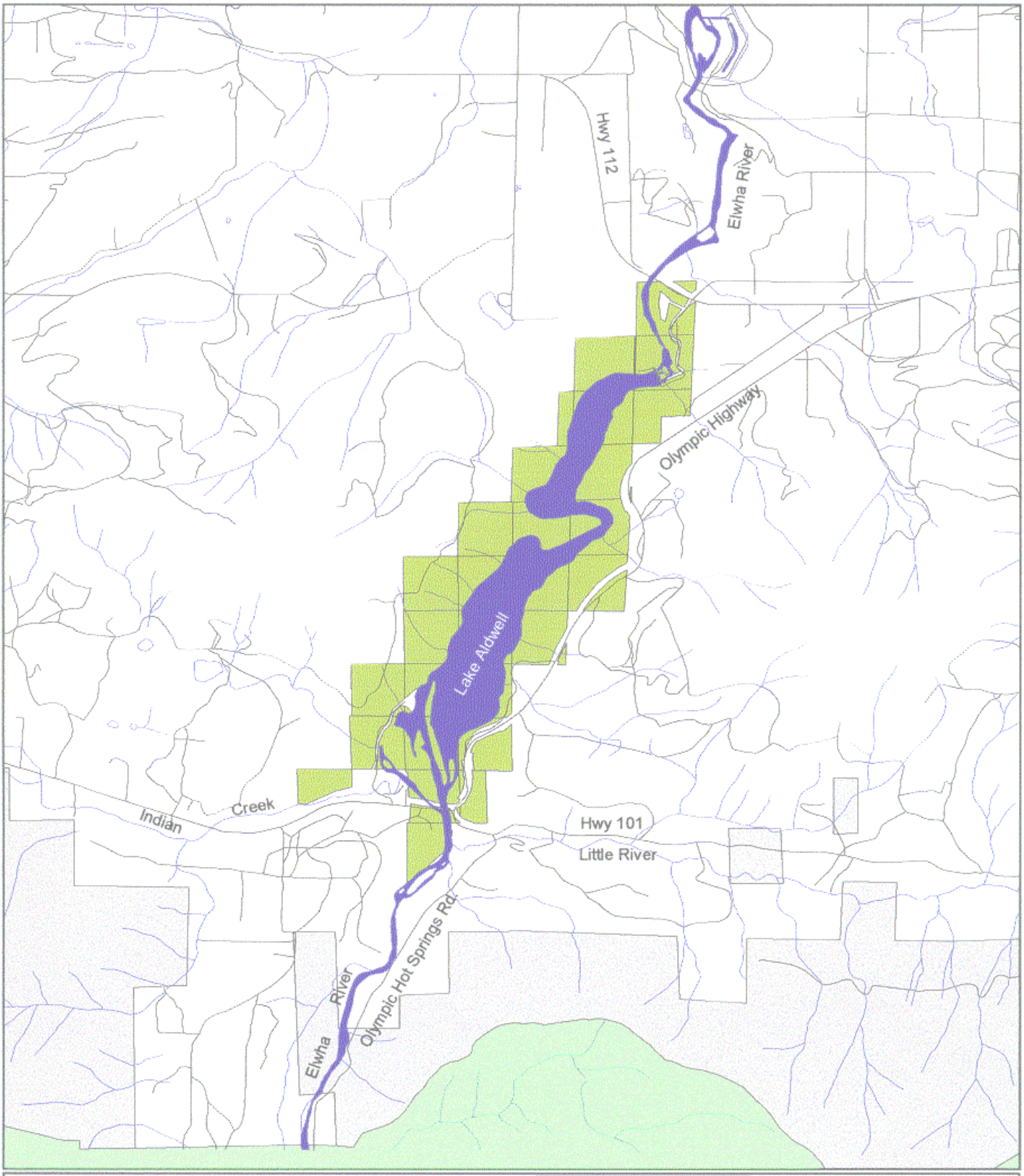

Figure 1-1
Project Area
and
Surrounding Lands

2. ALTERNATIVES

This chapter describes the alternatives considered in this assessment.

2.1 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

2.1.1 Alternative A, Management by the State of Washington

The State of Washington explored managing the lands associated with the Elwha Project but determined that they have no desire to pursue ownership (NPS, 1996a and 1996b). Because the State is on record as not wanting to manage these lands, this alternative was eliminated from detailed study.

2.1.2 Alternative B, Management by U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) explored managing the lands associated with the Elwha Project. The USFWS determined that the acquired land would not be large enough to support inclusion in the National Wildlife Refuge System. It is unlikely that USFWS could reconsider its position and develop a management plan prior to acquisition of the lands in early 2000. This alternative would not meet the Purpose and Need described in Chapter 1, which is to have an interim management plan in place prior to acquisition. Therefore, this alternative was eliminated from detailed study.

2.1.3 Alternative C, Management by the Lower Elwha Klallam Tribe

The lands associated with the Elwha Project qualify as trust lands for the Lower Elwha Klallam Tribe (NPS, 1996a and 1996b). This alternative may be considered in detail for the permanent management plan. However, funding for such a project could not be approved and a management plan could not be implemented prior to acquisition of the lands in early 2000. This alternative would not meet the Purpose and Need described in Chapter 1, which is to have an interim management plan in place prior to acquisition. Therefore, this alternative was eliminated from detailed study for the interim management plan.

2.1.4 Alternative D, Inclusion in Olympic National Park

The lands associated with the Elwha Project qualify for inclusion in Olympic National Park (NPS, 1996a and 1996b). This alternative may be considered in detail for the permanent management plan. However, the process of incorporating these lands into the Park could not be completed prior to acquisition of the lands in early 2000. This alternative would not meet the Purpose and Need described in Chapter 1, which is to have an interim management plan in place prior to acquisition. Therefore, this alternative was eliminated from detailed study for the interim management plan.

2.1.5 Alternative E, Management by the USDA Forest Service

Some scoping comments suggested that the Olympic National Forest acquire and manage the lands associated with the Elwha Project. The area is outside the proclaimed boundaries of the Olympic National Forest and it is not contiguous with any National Forest System land. The Forest Service can acquire land outside the boundaries of National Forests in Washington under the Pacific Northwest Streams program of the Land and Water Conservation Fund, in order to improve fish management. However, an Act of Congress would be required for the land to be transferred to the National Forest (personal communication, N. J. Erikson, Regional Lands Coordinator, USDA Forest Service, Dec. 6, 1999). It is unlikely that an Act of Congress could be passed prior to the scheduled acquisition of these lands in early 2000. To date, the Forest Service has not expressed interest in acquiring and managing the land.

This alternative may be considered in detail for the permanent management plan. However, there are too many questions that need to be answered to include this alternative in the analysis for the interim plan. Therefore, for the purpose of this interim plan, this alternative was eliminated from detailed study.

2.2 ALTERNATIVES CONSIDERED IN DETAIL

2.2.1 Alternative 1, No Action

The 1,061 acres outside the Park boundary, including the Elwha Dam, would continue to be managed and operated under present state and local authorities, laws, regulations, and conditions of general private land uses that have been typical of private land in the area. The existing laws and regulations would continue to be enforced by state and county authorities, not by NPS personnel. Emergency services would be provided by state and county authorities.

Recreation, such as fishing, hunting, and wildlife viewing, would continue to be managed by the Washington Department of Fish and Wildlife (WDFW). WDFW would continue to maintain the boat launch on the southwest corner of the lake, collect trash, and enforce laws and regulations. The Elwha Resort, which is privately owned and operated, would remain open, pending lease agreement with the property owner (Fort James Corporation). Access to the area for recreation, as well as parking, would not change. No education or interpretation programs would be implemented.

Operation of the dam, the powerplant, and power line corridors would not change. Management of the surrounding forests and minerals would continue as they have in the recent past. No timber harvest or mining would occur.

A No Action Alternative is required by NEPA. In cases where the current condition or management can not continue due to law or a change in ownership, the No Action Alternative is included as a benchmark. This benchmark is used to contrast the changes that other proposed alternatives would entail. In this case, the No Action Alternative can not be selected because the Elwha Act requires that the land be acquired. It is included as a benchmark only.

2.2.2 Alternative 2, Proposed Action

The 1,061 acres outside the Park boundary, including the Elwha Dam, would be managed under the oversight of the NPS in accordance with the declared policy of section 1(b) of the Wild and Scenic Rivers Act as required by the Elwha Act. However, except as noted below, the area would be managed as described under Alternative 1. Existing laws and regulations would continue to be enforced by state and county authorities, not by NPS personnel. Emergency services would be provided by state and county authorities, although wildland fire suppression would be provided by the Olympic National Park.

Recreation, such as fishing, hunting, and wildlife viewing, would continue to be managed by WDFW. WDFW would continue to maintain the boat launch on the southwest corner of the lake, collect trash, and enforce laws and regulations. The Elwha Resort would remain open for the remainder of its 10-year lease unless the owner decides to close it or sell it to the government. Contingent on funding, the government would offer to purchase the lease-hold rights to the resort and it would be closed. Access to the area for recreation, as well as parking, would not change. Education and interpretation programs would not be implemented.

An administrative or Secretarial (Secretary of the Interior) Order would clarify the National Park Service's authority to administer these lands outside of Olympic National Park for the interim period. This authority would provide for such land managing actions as, but not necessarily limited to: issuing rights-of-way and use permits; issuing emergency fire closures; and designating camping and other public uses in certain areas.

The dam and the powerplant would be operated by the Bureau of Reclamation (BOR), under NPS oversight. Power will continue to be produced until the first stage of dam removal begins. In the event that it is no longer economical or practical (due to mechanical failure or other unforeseen circumstances) to produce power prior to dam removal, the spillway gates may be opened, lowering the reservoir level 10 to 15 feet.

Cultural resources and tribal treaty rights would be protected under federal laws and regulations. The area would be available for tribal religious and ceremonial uses. Management of the surrounding forests and minerals would continue as they have in the recent past. No timber harvest or mining would occur. The NPS would be responsible for compliance with the Endangered Species Act (ESA), in consultation with state and county authorities.

2.2.3 Alternative 3

The 1,061 acres outside the Park boundary, including the Elwha Dam, would be managed by NPS personnel under applicable NPS regulations and in accordance with the declared policy of section 1(b) of the Wild and Scenic Rivers Act as required by the Elwha Act. Laws and regulations would be jointly enforced by state and county authorities and NPS personnel. Emergency services, such as fire protection and search and rescue, would be provided by NPS personnel in cooperation with state and county authorities.

Recreation use and waste disposal would be managed by NPS personnel. However, the boat launch, which is owned by the state, would continue to be managed by WDFW unless ownership is transferred to the federal government. Access for recreation, including parking, would be maintained. Contingent on funding, the NPS would offer to purchase the lease-hold rights to the Elwha Resort and it would be closed. Education and interpretation programs would be implemented within available funding constraints. Hunting would not be permitted. Limited fishing would be permitted. Cultural resources would be protected under federal laws and regulations. The area would be available for tribal cultural and religious uses.

An administrative or Secretarial (Secretary of the Interior) Order would clarify the National Park Service's authority to administer these lands outside of Olympic National Park for the

interim period. This authority would provide for such land managing actions as, but not necessarily limited to: issuing rights-of-way and use permits; issuing emergency fire closures; and designating camping and other public uses in certain areas.

The dam and the powerplant would be operated by the BOR under NPS oversight. The dam would be managed to support fish recovery. Power will continue to be produced until the first stage of dam removal begins. In the event that it is no longer economical or practical (due to mechanical failure or other unforeseen circumstances) to produce power prior to dam removal, the spillway gates may be opened, lowering the reservoir level 10-15 feet. No timber harvest or mining would occur. The NPS would comply with the ESA on these lands.

A comparison of the effects of the three alternatives on each of the key issues is provided in Table 2-1.

Table 2-1. Comparison of Effects on Issues

Issue	**Alternative 1**	**Alternative 2**	**Alternative 3**
Tribal Rights	No effect	Positive effect	Positive effect
Law Enforcement by NPS Personnel	No	No	Joint state and local
Access for Recreation	No change	No change	No change
Fishing Permitted	Yes	Yes	Yes
Hunting Permitted	Yes	Yes	No
Dam Operated for Power Production	Yes	Yes	Yes
Dam Operated to Support Fish Recovery	No	Yes	Yes

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

This chapter describes the affected environment and the effects of each alternative on the environment.

3.1 GEOLOGY/GEOMORPHOLOGY

3.1.1 Affected Environment

3.1.1.1 Bedrock Geology

The Elwha River basin generally overlies heavily folded and faulted sedimentary and metamorphic rocks. In the project area, these rocks are chiefly conglomerates and deformed sandstones. There are some fault zones in the vicinity of the project area, but there is no evidence of recent fault activity (FERC, 1993).

3.1.1.2 Surficial Geology

The Elwha River valley consists of a series of relatively narrow bedrock canyons and wide lower-gradient, flat alluvial sections. Surface deposits in the project area are dominated by glacial deposits and recent alluvium. The glacial sediments provide much of the sediment transported by the Elwha River. Alpine glaciers, which extended at least as far as the southern end of Lake Aldwell (FERC, 1993), carved out the wide bottom lands in weaker rock units, whereas canyons were formed in more resistant lithologies. The topography within the study area was influenced both by alpine glaciers flowing from the high Olympic Mountains, and the Juan De Fuca lobe of the Vashon continental glacier, which covered the lower Elwha River (NPS, 1996a).

A sequence of alluvial, glacial, and non-glacial deposits comprises the unconsolidated hydrogeologic system in the lower Elwha River basin, which includes the study area. The older glacial and non-glacial units were deposited first, covering the bedrock surface that slopes downward toward the north. The Elwha River valley is cut into these deposits. Recently deposited alluvial sediment partially fills the valley floor. The width of the alluvium is restricted by relatively steep bedrock and glacial deposit bluffs (NPS, 1996a).

Total tributary mileage in the Elwha watershed is 77.4, with the major portion of this in Little River and Indian Creek. The Elwha Dam is located at river mile (RM) 4.9. Lake Aldwell, its reservoir, lies within a deep valley. Two major tributaries enter the upper end of Lake

Aldwell: Indian Creek at RM 7.5, and Little River at RM 7.8. Indian Creek drains Lake Sutherland and flows through an area of second growth timber and intermittent farmland (FERC, 1993).

Sediment discharge and channel morphology in the middle and lower reaches have been altered by the dams, and impoundment of the river in Lake Mills and Lake Aldwell has inundated 5.3 miles of riverine and 684 acres of lowland area. Within the project area, Lake Aldwell inundates 2.8 miles of the Elwha River. A canyon divides the reservoir into two wide alluvial reaches. Approximately 3.88 million cubic yards of sediment are trapped in Lake Aldwell and its delta. The delta contains an estimated 1.78 million cubic yards, as much as 4 feet thick, composed of sand and gravel with smaller amounts of clay, silt, cobbles, and boulders. Downstream of this delta, 2.1 million cubic yards of lake-bottom sediments are composed of fine-grained sediments, with minor amounts of sand. This material is 5 to 6 feet thick in the southern basin, thinning to less than 1 foot in the narrow canyon section (NPS, 1996a).

Upstream of Lake Aldwell, the Elwha River is 200 to 400 feet wide. The overall channel slope of the middle reach is 0.7 percent. There is little reworking of valley alluvium by lateral channel migration upstream of Lake Aldwell. Also, the amount of sand and gravel in the riverbed is noticeably lacking compared to the river upstream from Lake Mills. Sediment in this reach comes from tributaries when they are in active flood stage and from sediment stored along the channel in bars and terraces (NPS, 1996a).

Just downstream of the Elwha Dam, the river is constrained by the steep bedrock walls of Elwha Canyon. In the next 0.5 mile of the river below Elwha Canyon, the stream gradient is less steep and the channel floodway widens to approximately 1,500 feet (NPS, 1996a).

3.1.2 Environmental Effects

3.1.2.1 Alternative 1, No Action

Current conditions would continue under Alternative 1. There would be no change in operations or management. Therefore, no direct or indirect effects on fluvial processes would occur under Alternative 1.

3.1.2.2 Alternative 2, Proposed Action

Under the proposed action, the project lands, including the Elwha Dam, would be managed under the oversight of the NPS, but the land would continue to be managed in a similar manner as under Alternative 1. The dam and powerplant would be operated by the BOR with

the goal of supporting fish recovery. As long as power is produced, the reservoir level would remain the same and flow rates would remain the same. Therefore, there would be no downstream effects on fluvial processes.

If power production ceases and the spillway gates are opened, reservoir levels would be lowered 10 to 15 feet. This would correspond to the initial phase of pre-removal activities discussed in the EIS on dam removal (NPS 1996a and 1996b). No additional downstream effects on fluvial processes other than those associated with dam removal activities, as discussed in the EIS, are anticipated under this alternative. If the spillway gates are opened during the period covered by the Interim Management Plan, these effects would include the following: 1) short-term increased suspended sediment concentrations downstream of the dam; 2) the exposure of sand, silt, and gravel terraces along the margins of the reservoir; 3) erosion of terrace materials; 4) formation of new channels in the newly drained areas; and 5) the formation of wetlands. Nearly all of the fine-grained sediment introduced during initial drawdown activities is expected to move rapidly through the system. These anticipated effects are described in detail in NPS 1996a and 1996b.

No timber harvest would occur within the project area. Therefore, mass wasting and sediment delivery rates to tributaries of the Elwha River are expected to remain unchanged. Because there is no anticipated change in either sediment or wood loading rates within the Affected Environment, direct or indirect effects on the fluvial system related to these two processes are unlikely.

3.1.2.3 Alternative 3

In the context of the effects on fluvial processes, Alternative 3 is essentially the same as Alternative 2. Under Alternative 3, the project area, including Elwha Dam operations, would be managed by the National Park Service, in accordance with the declared policy of section 1(b) of the Wild and Scenic Rivers Act. No timber harvest or mining would occur. The Elwha Dam and the powerplant would be operated by the BOR with the goal of supporting fish recovery. As under Alternative 2, it is not yet known if power will continue to be produced. If power is produced, the reservoir level would remain the same and flow rates would remain the same. Therefore, there would be no downstream effects on fluvial processes.

If power is not produced and the spillway gates are opened, reservoir levels would be lowered 10 to 15 feet. This would correspond to the initial phase of pre-removal activities discussed in the EIS on dam removal (NPS 1996a and 1996b). No additional downstream effects on fluvial processes other than those associated with dam removal activities, as discussed in the EIS, are anticipated under this alternative. If the spillway gates are opened during the period covered by the Interim Management Plan, these effects would include the following: 1) short-term increased suspended sediment concentrations downstream of the dam; 2) the exposure of sand, silt, and gravel terraces along the margins of the reservoir; 3) erosion of terrace materials; 4) formation of new channels in the newly drained areas; and 5) the formation of wetlands around the margins of the reservoir. Nearly all of the fine-grained sediment introduced during initial drawdown activities is expected to move rapidly through the system. These anticipated effects are described in detail in NPS 1996a and 1996b.

3.2 WATER QUANTITY AND WATER QUALITY

3.2.1 Affected Environment

3.2.1.1 Surface Water Quantity

Annual precipitation in the Elwha River basin ranges from 220 inches in its upper reaches to 56 inches near the mouth of the river. Average annual discharge is 1,500 cubic feet per second (cfs). Discharge is influenced by winter storms and spring snowmelt and by baseflow conditions during the summer and fall. The lowest flow period is during late summer and fall, when average discharges range from 618 to 952 cfs (NPS, 1996a).

Flow regimes of the river and its tributaries are nearly natural because the dams are almost always operated in “run-of-river” mode. This means very little of the water entering the drainage is stored or released differently from the way it was before the dams were built. Thus, the Lake Aldwell and Lake Mills reservoirs reduce the effects of only the shortest duration and most minor floods. Otherwise, the rate that water enters and exits the reservoirs at any given time is roughly the same. As a result, and because the reservoirs have little flood storage volume, the dams provide very minimal flood protection and only during short duration events (storms or snowmelt) (NPS, 1996a).

The Elwha River typically experiences two periods of high runoff: 1) November through March from heavy rains, and 2) during the spring snowmelt from May through June. Typically, floods are characterized by sharp rises in discharge (usually less than 24 hours to

peak) and a gradual recession of two days or more. It is not uncommon for two or more periods of high flows to follow one another in rapid succession (NPS, 1996a).

Flood discharges have ranged from 4,680 cfs in 1936 to 41,600 cfs in 1897. The greatest recorded discharge in recent years was 28,700 cfs in 1990 (recurrence interval of 14 years), recorded at the McDonald bridge gauge. A frequency analysis of yearly peak discharges shows a 5,000 cfs flood has a 97 percent chance of occurring every year; a 13,000 cfs flood has a 50 percent chance of occurring each year. The highest measured flood of 41,600 cfs has a 71-year return period, or a 1.4 percent chance of occurring each year (NPS, 1996a).

3.2.1.2 Surface Water Quality

Overall, the Elwha River has relatively low concentrations of dissolved and suspended sediment loads, nutrients, and organics. Changes in natural water quality occur in the lower part of the watershed, mostly as a result of reduced sediment load and elevated water temperatures during the summer. Suspended sediment concentrations and turbidity of the lower river are related to reservoir trapping efficiency, flood flows, logging, agricultural practices, and bank erosion (NPS, 1996a).

Water temperatures in the Elwha River are lowest during January and February and highest during August and September. Seasonal patterns in water temperature are highly influenced by yearly discharge, climatic conditions, and the presence of the dams. The dams have caused water temperatures to be elevated during critical summer months, sometimes severely degrading water quality for fish and other aquatic life in the river. Because of low algae production, Lake Mills and Lake Aldwell do not reduce downstream dissolved oxygen or increase turbidity and temperature as a result of biological activity (NPS, 1996a).

Washington Department of Ecology's 303(d) list indicates that the Elwha River has polychlorinated biphenyl (PCB) contamination at the MacDonald Bridge gage site and elevated water temperatures at the WDFW rearing channel.

3.2.1.3 Groundwater Quantity

In the lower Elwha River basin, younger unconsolidated deposits overlie the bedrock. Because the rock impedes flow, the groundwater is primarily contained in the overlying unconsolidated deposits. Above Elwha Dam, the alluvial aquifer is restricted to the river channel and narrow floodplain within the valley and is bounded primarily by bedrock. The alluvium thickens and laterally extends into the lower Indian Creek valley (NPS, 1996a). The glacial deposits yield water at rates generally less than 20 gallons per minute (gpm).

Deposits of sand and gravel found at the top of the bluffs are unsaturated and do not supply water (NPS, 1996a).

Below Elwha Dam, the Elwha River valley is divided into three distinct alluvium-filled groundwater sub-basins separated by bedrock outcrops or constrictions in the surrounding glacial deposits. The upper sub-basin is located between RM 4.0 and RM 3.1, which is just north of the project area. The approximate thickness of this aquifer is 75 feet and it covers about 60 acres. Transmissivity is relatively low (75,000 gallons per day [gpd] per foot of aquifer compared to 400,000 gpd per foot of aquifer in the lower sub-basin) (NPS, 1996a).

Dry Creek Water Association wells are located at the lower end of the upper basin (about RM 3.0). The Dry Creek Water Association holds a groundwater right for 0.6 cfs and average use is approximately 0.33 cfs (150 gpm). The City of Port Angeles holds a ground water right for 50 cfs, with a current pumping capacity of 17 cfs. Total use by the five major groundwater purveyors in the Elwha River valley is approximately 22.3 cfs (NPS, 1996a).

3.2.1.4 Groundwater Quality

Because the entire headwater area is protected within Olympic National Park, the groundwater in the Elwha River watershed is of excellent quality. However, due to the proximity of the Dry Creek Water Association wells to the river channel, turbidity in the river increases turbidity in their well water supply. Groundwater withdrawals are periodically tested for several contaminants as required by the Washington State Department of Health. Non-point source pollution from agricultural and urban land use areas has a minor influence on groundwater quality. There is no indication of saltwater intrusion (NPS, 1996a).

3.2.2 Environmental Effects

3.2.2.1 Alternative 1, No Action

There would be no change in operations or management. Therefore, no direct or indirect effects on water quality or quantity would occur under Alternative 1.

3.2.2.2 Alternative 2, Proposed Action

As long as power continues to be produced, the reservoir level would remain the same and flow rates would remain the same. Therefore, there would be no downstream effects on water quantity or quality.

If power production ceases and the spillway gates are opened, reservoir levels would be lowered 10 to 15 feet. This would correspond to the initial phase of pre-removal activities discussed in the EIS on dam removal (NPS 1996a and 1996b). No additional downstream effects on water quantity or water quality other than those associated with dam removal activities as discussed in NPS (1996a and 1996b) are anticipated under this alternative. If the spillway gates are opened during the period covered by the Interim Management Plan, these effects would include the following: 1) short-term increased suspended sediment concentrations downstream of the dam; 2) the exposure of sand, silt, and gravel terraces along the margins of the reservoir; 3) erosion of terrace materials; 4) formation of new channels in the newly drained areas; and 5) the formation of wetlands around the edges of the valley flats. The increase in suspended sediment would have a short-term adverse impact on water quality both within and downstream of the reservoir. Nearly all of the fine-grained sediment introduced during initial drawdown activities is expected to move rapidly through the system. The anticipated effects are described in detail in NPS 1996a and 1996b.

The key water quality parameters of concern in the context of the proposed action are water temperature and turbidity. Lake Mills, and to a lesser extent Lake Aldwell, increase temperatures during summer due to their relatively large surface area and long hydraulic residence time (FERC, 1993). Because Lake Mills has a larger volume and longer hydraulic residence time, downstream water temperature is more strongly affected by the Glines Canyon Dam operation (which will not be altered as a result of this action) than by the Elwha Dam.

There may be a change as to whether flow from Lake Aldwell reservoir passes through turbines or over spillways, but these changes would not be expected to significantly alter downstream temperatures or turbidity because the lake is not stratified and it is a surface diversion. Therefore, no direct or indirect effects on water temperature are expected under this alternative.

No timber harvest or road construction would occur within the affected environment. Therefore, rates of sediment delivery to the affected waters within the study area and associated turbidity levels are expected to remain unchanged, except for changes related to potential drawdown activities described in NPS 1995 and 1996.

3.2.2.3 Alternative 3

Effects on water quantity and quality would be the same as those described under Alternative 2 for both the option of producing power and of not producing power and opening the spillway gates.

3.2.2.4 Cumulative Impacts

If the reservoir level remains the same, no cumulative effects on water resources are expected under any of the alternatives because: 1) Lake Aldwell reservoir release rates would remain the same, 2) downstream water temperature is not significantly altered by Elwha Dam operations, and 3) sediment delivery rates to the affected waters are not expected to change. If the reservoir level is lowered 10 to 15 feet, cumulative effects would be those associated with dam removal. These effects are discussed in the two EISs (NPS, 1996a and 1996b).

3.3 SOILS

3.3.1 Affected Environment

Relatively few major soil types are found within the project area. Soils throughout the area are post-Pleistocene (less than 8,000 years old) and are developed either directly from glacial sediments, or on alluvium or colluvium derived primarily from glacial sediments. On steep side slopes, the soils are well-drained colluvial units. On floodplain areas, the soils are well-drained gravelly loams or gravelly sandy loams that become increasingly gravelly with depth (FERC, 1993). Major soil units occurring within the project area are described in the following sections.

3.3.1.1 Terbies Very Gravelly Sandy Loam, 65 to 85 Percent Slopes

Most of the soils along the margin of Lake Aldwell are classified as "Terbies very gravelly sandy loam" (USDA Soil Conservation Service, 1979). This deep, well-drained soil is common in the region on mountainsides (65 to 85 percent slopes). It is formed in residuum and colluvium derived from sandstone, siltstone, and conglomerate. Permeability is moderate. The available water capacity is low. The effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is severe (USDA Soil Conservation Service, 1979).

This soil unit is used as a woodland, suited to the production of Douglas fir. Trees of limited extent are western hemlock, grand fir, western redcedar, and bigleaf maple. The main limitation for harvesting timber is steepness of slope. During the first few years following

road construction in combination with clearcutting, road failures and landslides are likely to occur (USDA Soil Conservation Service, 1979).

3.3.1.2 Typic Xerofluvents, Nearly Level

Along the southwest margin of Lake Aldwell, the soil type is classified as "Typic Xerofluvents" (USDA Soil Conservation Service, 1979). These very deep, somewhat excessively drained soils are on floodplains. They are formed in recent alluvium where slopes are 0 to 5 percent. Permeability of Typic Xerofluvents is rapid. The available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. These soils are subject to occasional, brief periods of flooding from December through April (USDA Soil Conservation Service, 1979).

This unit is used as a woodland, suited to the production of red alder. Trees of limited extent are grand fir and Douglas fir. The main limitation for harvesting timber is the hazard of flooding. The risk of flooding limits the use of equipment to dry periods (USDA Soil Conservation Service, 1979).

3.3.1.3 Louella Gravelly Loam, 30 to 65 Percent Slopes

Along the southeast margin of Lake Aldwell, the soil type is classified as "Louella gravelly loam, 30 to 65 percent slopes" (USDA Soil Conservation Service, 1979). This very deep, well-drained soil is on mountainsides (slopes 30 to 65 percent). It is formed in residuum and colluvium derived from basalt and flow breccia. Permeability is moderate. The available water capacity is moderately high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate (USDA Soil Conservation Service, 1979).

This unit is used as a woodland, suited to the production of Douglas fir. Trees of limited extent include grand fir, western hemlock, western redcedar, and bigleaf maple. The main limitation for harvesting timber is steepness of slope. Establishing plant cover on the steeper slopes that have been cut or filled reduces erosion. Cutbanks may slump when the soil is saturated (USDA Soil Conservation Service, 1979).

3.3.1.4 Elwha Gravelly Sandy Loam, 0 to 35 Percent Slopes

The upland soils within the northern portion of the project area are mainly classified as "Elwha gravelly sandy loam, 0 to 15 percent slopes," while those to the south are the same soil type but on slightly steeper slopes (15 to 35 percent) (USDA Soil Conservation Service, 1979). This moderately deep, moderately well-drained soil is on hills. It is formed in

compact glacial till. Permeability is moderate to the compact till and very slow through it. The available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is slight. Water is perched above the compact glacial till from January through April. The effect of the till layer on use and management is similar to that of a hardpan (USDA Soil Conservation Service, 1979).

This unit is used mainly as woodland, suited to the production of Douglas fir. Trees of limited extent are red alder, western hemlock, grand fir, western redcedar, and bigleaf maple. This unit has also been developed into homesites. The main limitation is wetness. Excavation for roads and buildings increases the risk of erosion (USDA Soil Conservation Service, 1979).

3.3.1.5 Puget Silt Loam

There is a small amount of soil classified as "Puget silt loam" in the southernmost portion of the project area (USDA Soil Conservation Service, 1979). This very deep, poorly drained soil is on low terraces and floodplains (slope of 0 to 3 percent). It has been artificially drained. The soils formed in recent alluvium. Permeability is moderately slow. The available water capacity is high. The effective rooting depth is limited by a seasonal high water table that is at a depth of 4 to 6 feet from November through April. Runoff is medium, and the hazard of water erosion is slight. This soil is subject to occasional flooding for brief periods from December through March (USDA Soil Conservation Service, 1979).

This unit is used mainly as hayland, pastureland, and cropland. It is also used for homesites and woodland. The unit is suited to pasture and irrigated crops. The main limitation is the hazard of flooding. It is also suited to the production of red alder. Trees of limited extent include black cottonwood, western redcedar, and willow. The main limitation for harvesting timber is muddiness when the soil is welt. If the unit is used for homesite development, the main limitations are the hazard of flooding and wetness. Excavation for roads and buildings increases the risk of erosion (USDA Soil Conservation Service, 1979).

3.3.2 Environmental Effects

3.3.2.1 Alternative 1, No Action

Under Alternative 1, current conditions would continue. No timber harvest or road building is expected to occur. Therefore, no changes in mass wasting rates related to forest practices are expected. No direct or indirect effects on soil resources would occur under Alternative 1.

3.3.2.2 Alternative 2, Proposed Action

No downstream effects on soil resources are anticipated (other than those associated with dam removal activities as discussed in NPS 1996a and 1996b) under either the power production or the no-power production options.

3.3.2.3 Alternative 3

In context of the effects on soil resources, Alternative 3 is essentially the same as Alternatives 1 and 2. No downstream effects on soil resources are anticipated (other than those associated with dam removal activities as discussed in NPS 1996a and 1996b) under either the power production or the no-power production options.

3.3.2.4 Cumulative Impacts

No cumulative impacts to soil resources are expected under any of the alternatives because there are no expected changes in 1) timber harvest on unstable slopes, 2) road construction on unstable slopes, or 3) patterns of development that would result in soil disturbance.

3.4 VEGETATION

3.4.1 Affected Environment

The lands associated with the Elwha Project are in the western hemlock (*Tsuga heterophylla*) zone. This is the most common vegetation zone in western Washington (Franklin and Dryness, 1973). Because of the maritime influence, the climate is generally wet and mild. However, summers are relatively dry. Most of the area has been logged and currently supports 30- to 90-year-old forests; no old-growth forest remains (FERC, 1993). Plant communities within the western hemlock zone are shaped by different moisture regimes due to elevation, soil type, aspect, and location.

Conifer forest, dominated by mature western hemlock and Douglas-fir (*Pseudotsuga menziesii)*, covers 44 percent of the land area (the reservoir covers approximately 270 acres of the 1,061-acre property). Approximately 17 percent is hardwood forest (75 percent of which is mature and 25 percent contains young, pole-sized trees). Another 24 percent is mature, mixed conifer and hardwood forest. Palustrine forest and other wetland communities cover 6 percent, while another 2 percent is riverine. Less than 4 percent is deciduous shrub. Less than 3 percent of the land area has been developed, half of which has been paved and half of which is vegetated (FERC, 1993).

3.4.1.1 Sensitive Plant Species

One federally Threatened and state Sensitive species, tall bugbane (*Cimicifuga elata*), may occur in the project area (WNHP, 1997). Two other state Sensitive species, the giant helleborine (*Epipactis gigantea*) and the branching montia (*Montia diffusa*), have been documented in the Elwha River drainage and therefore potentially occur in the project area (WNHP, 1997). Both tall bugbane and branching montia generally grow in moist forests. Giant helleborine is a nonshowy orchid that prefers streambanks, seeps, and lake margins (Hitchcock and Cronquist, 1973 as cited in NPS, 1996a). Surveys conducted in 1990 in the Elwha River drainage found a population of giant helleborine in an area outside of this project area (FERC, 1993); however, the population could not be relocated in a 1995 survey (NPS, 1996a).

3.4.2 Environmental Effects

Vegetation management is expected to be similar under all alternatives. The area would continue to be managed to conserve existing vegetation in Alternatives 1 and 2, at least during the interim period that this plan would cover. Under Alternative 3, the NPS would maintain natural vegetation in its natural state and seek to restore natural vegetation in areas that have been altered. If shore lines are exposed because the reservoir level is lowered, they would be revegetated as described in NPS 1996 under Alternatives 2 and 3. Another difference would be the possible restoration of natural vegetation in the developed area following purchase of the Elwha Resort under Alternatives 2 and 3 and implementation of a program to remove non-native vegetation under Alternative 3.

3.5 WILDLIFE

3.5.1 Affected Environment

The habitat in the project area around Lake Aldwell consists mostly of mature second-growth forest (NPS, 1996a). No old-growth forest remains adjacent to Lake Aldwell. Other habitats in the project area include mixed conifer, hardwood, riparian, and wetland communities (FERC, 1993). Some development occurs near the Elwha Dam, and Highway 101 runs along the eastern edge of the project area.

Currently, the Elwha River drainage supports a wide variety of amphibians, reptiles, birds, and large and small mammals. However, the lack of salmon carcasses in the middle and upper river and the inundation of lowland valley habitat by Lake Aldwell have adversely affected some wildlife populations (NPS et al., 1994). The bottom floodplain and riparian areas inundated by the reservoir once provided important habitat for grazing, shelter, and reproduction for a variety of species.

3.5.1.1 Reptiles and Amphibians

Surveys in 1995 confirmed three species of reptiles and seven amphibians in the project vicinity. These are the northern alligator lizard, common garter snake, northwestern garter snake, Olympic salamander, rough-skinned newt, ensatina, western red-backed salamander, tailed frog, northern red-legged frog, and the Pacific tree frog. Other previously recorded or suspected species include the rubber boa, Cope's giant salamander, northwestern salamander, and Van Dyke's salamander (Loafman et al., 1995 as cited in NPS, 1996a; Larsen, 1997).

3.5.1.2 Birds

Birds include numerous songbirds, waterfowl, raptors, and marine species. Up to 11 species of raptors (predatory birds) have been observed in the Elwha River drainage, including the red-tailed hawk, northern pygmy owl, osprey, and sharp-shinned hawk (Sharpe, 1990 as cited in NPS, 1996a). The bald eagle, northern spotted owl, and the northern goshawk are known to occur in the area and are addressed in Section 3.5.1.4.

Lake Aldwell and the Elwha River drainage provide habitat for a wide variety of waterfowl. The common goldeneye, bufflehead, and lesser scaup are common winter residents on the reservoir. Common mergansers, mallard, and harlequin ducks have been observed year-round on the lower and middle reaches of the river and breed in the Elwha area although no nests are known in the project area (Sharpe, 1990 as cited in NPS 1996a; Smith et al., 1997).

Historically, swans did not use the main river upstream of the river mouth due to lack of swan habitat. With the formation of Lake Aldwell, trumpeter swans have been using the lake as an early winter staging area (November through December). Use of the lake is affected by the availability of aquatic plant resources, which varies from year to year depending on early season flood events (Jordan, 1996). Although the Pacific Coast population of trumpeter swans is of local concern, it does not have any federal status.

3.5.1.3 Mammals

Roosevelt elk and black-tailed deer are found throughout the drainage. Important elk calving areas are located south of the project area, above Lake Mills and near Altaire Campground. Currently no elk calving areas are known near Lake Aldwell, however, the area may provide winter habitat. Optimal winter habitat for elk includes a variety of forest types that provide both forage and thermal cover. Mature second-growth conifer forests primarily provide thermal cover. Winter forage appears to be the limiting factor for elk populations in the Elwha River drainage.

A variety of other mammals—including bats, beaver, mink, river otter, marten, and other small mammals—are known to occur in the project area. Many of the small mammal species provide the major prey base for most terrestrial carnivores and many raptors in the Elwha River drainage.

3.5.1.4 Species of Special Concern

The USFWS has documented three wildlife species with Threatened status in the project area: bald eagle, marbled murrelet, and northern spotted owl. Other species of special concern that may occur in the project area include USFWS Species of Concern, Candidates for state listing, State Monitor species, and Sensitive plant species. These species are discussed below.

Threatened and Endangered Wildlife Species

The bald eagle (*Haliaeetus leucocephalus*), a federal and state Threatened species, has been observed year-round in the project area. Suitable nesting and foraging habitat is available in the project area, although no nests or winter roost sites have been documented along the reservoir or the river (personal communication, Shelly Ament, Wildlife Biologist, WDFW, Sequim, October 18, 1999). Flight surveys conducted by the State in 1997 did not locate any nests near Lake Aldwell (personal communication, S. Hall, Wildlife Biologist, Olympic National Park, October 15, 1999). Nesting eagles do occur along the Strait of Juan de Fuca and at Crescent Lake. Eagle densities appear to decrease with distance from the delta (FERC, 1993). High prey availability along the coast in comparison to the middle and upper river sections may explain the lower use of the area.

The marbled murrelet (*Brachyramphus marmoratus*), a federal and state Threatened species, has been observed flying in the Elwha River drainage and nests in the upper drainage. The habitat around Lake Aldwell is considered only marginally suitable according to USFWS and WDFW (NPS, 1996a). All National Forest Service lands and some state lands near the

Elwha River are designated critical habitat, although no designated critical habitat occurs in the project area. According to a 1995-1996 study, no evidence of nesting occurs in the vicinity of the dam, although low numbers of birds travel daily north/south though the project area (Hathorn et al., 1995 and 1996 as cited in NPS, 1996b). Surveys conducted in Olympic National Park from 1997 through 1999 have demonstrated that most sites in the Park are considered occupied (personal communication, S. Hall, Wildlife Biologist, Olympic National Park, October 15, 1999). Therefore, the project area apparently serves as a flight corridor between the marine environment and nesting stands along the upper reaches of the Elwha valley or tributaries (NPS, 1996a). No murrelets were observed feeding or resting on Lake Aldwell in 1990.

The northern spotted owl (*Strix occidentalis*), a federal Threatened and state Endangered species, primarily uses old growth and mature conifer forests (Thomas et al., 1990). One active nest site occurs in the project area, over one mile from Elwha Dam. This nest has been active for approximately 10 years (personal communication, B. Biswell, Wildlife Biologist, Pacific Northwest Research Station, USDA Forest Service, Olympia, October 18, 1999). Most of the forests adjacent to Lake Aldwell and the Elwha Dam facilities are mature second growth, which is not optimum habitat for spotted owls. However, foraging, dispersing, and nesting owls are known to use the area (personal communication, B. Biswell, Wildlife Biologist, Pacific Northwest Research Station, USDA Forest Service, Olympia, October 18, 1999 and Shelley Hall, Wildlife biologist, Olympic National Park, November, 1999).

Other Species of Special Concern

The Townsend's big-eared bat (*Plecotus townsendii*) is a USFWS Species of Concern and a state Candidate species. This species uses a variety of forest types, mainly at low and mid-elevations. Hibernacula and maternity sites can occur in caves, mines, buildings, and the underside of bridges and are sensitive to disturbance (Johnson and Cassidy, 1997). No hibernacula or maternity sites are known in the project area, although habitat for the bat does occur.

The pacific fisher (*Martes pennanti*) is a USFWS Species of Concern and a state Endangered species. Although there is considered to be good habitat for fisher in the Elwha River drainage, this species is extremely rare and may even be extinct on the Olympic Peninsula (FERC, 1993).

The harlequin duck (*Histrionicus histrionicus*), a USFWS Species of Concern, typically breeds in forests adjacent to swift-moving streams. The Elwha River drainage, above and below the lake, is considered prime nesting habitat; however, the area along Lake Aldwell is not likely nesting habitat. Two pairs have nested between Lake Aldwell and the Glines Canyon Dam, outside the project area.

The northern goshawk (*Accipiter gentilis*), a USFWS Species of Concern and a state Candidate species, is known to breed in the Elwha River drainage but no nests are known within the project area. Breeding habitat for goshawks includes large tracts of mature and old growth forest where they can maneuver in and below the canopy to forage and where large trees are available for nesting (Crocker-Bedford, 1990).

The northern red-legged frog (*Rana aurora aurora*), a USFWS Species of Concern, occurs in moist forests, riparian areas, slow-moving, streams and ponds (Nussbaum et al., 1983). This species can be found several hundred yards from water during non-breeding periods. Breeding habitat generally consists of water with little or no flow and sturdy underwater stems for egg attachment. Northern red-legged frogs are known to occur in the Elwha River drainage.

Species considered to be Candidates for state listing that may occur in the project area include the common loon (*Gavia immer*), golden eagle (*Aquila chrysaetos*), pileated woodpecker (*Dryocopus pileatus*), Vaux's swift (*Chaetura vauxi*), western toad (*Bufo boreas*), and the valley silverspot butterfly (*Speyeria zerene bremnerii*).

Species considered to be State Monitor species that may occur in the project area include osprey (*Pandion haliaetus*), great blue heron (*Ardea herodias*), barred owl (*Strix varia*), and the turkey vulture (*Cathartes aura*).

3.5.2 Environmental Effects

3.5.2.1 Alternative 1, No Action

Under Alternative 1, current conditions are expected to persist. Wildlife management such as hunting, trapping, and wildlife viewing would continue to be managed by WDFW and these activities are expected to continue at the current level. Timber harvest is not expected to occur. No change in wildlife habitats and species is expected under Alternative 1.

Current management of the known spotted owl nest site in the project area would continue under the WDFW. No timber harvest is expected to occur in the area of the known spotted owl nest site. If any harvest activities were to take place, the Washington Forest Practices

regulations would regulate the amount and timing of harvest activities allowed in the vicinity of the nest site.

3.5.2.2 Alternative 2, Proposed Action

Under the proposed action, with oversight from the NPS, effects on wildlife habitats and species are expected to be the same as under Alternative 1, except as noted below. Wildlife management such as hunting, trapping, and wildlife viewing would continue to be managed by WDFW and these activities are expected to continue at the current level. Timber harvest would not occur.

The known spotted owl nest site would be fully protected because there would be no timber harvest activities allowed. Protection of the nest site would fall under the Endangered Species Act (ESA), which is more restrictive than the current Washington Forest Practices regulations.

If power production ceases, the spillway may be opened, lowering the lake level 10 to 15 feet. This is consistent with pre-dam removal activities associated with dam removal, as discussed in the EIS (NPS, 1996a). Under this option, swans and other waterfowl could be negatively affected. Lowering the lake level 10 to 15 feet would disrupt the silt ledge where aquatic vegetation currently grows. This would eliminate approximately 20 acres of foraging habitat for swans and other waterfowl on Lake Aldwell. Swans move frequently to respond to changing habitat conditions, such as when food resources are unavailable due to early season flood events. As during these periods, swans are expected to utilize other suitable habitat in the area such as fresh water and brackish lakes and small wetlands on the Peninsula.

3.5.2.3 Alternative 3

Under Alternative 3, the project area would be managed by the NPS. Management goals would be to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and ecological integrity of plants and animals. In addition, wildlife management should minimize human impacts on natural wildlife population dynamics, while protecting native wildlife populations against harvest, removal, destruction, harassment, or harm through human action (NPS, 1988a as cited in NPS, 1996a). Therefore, there would be no timber harvest or hunting allowed in the project area under this alternative. Wildlife habitats and species are likely to be positively affected under Alternative 3.

The known spotted owl nest site would be fully protected because no timber harvest activities would be allowed. Protection of the nest site would fall under the ESA, which is more restrictive than the current Washington Forest Practices regulations.

If the spillway is opened, effects on swans and other water fowl would be the same as described under Alternative 2. There would likely be less human disturbance to wildlife under Alternative 3 because hunting and trapping would not be allowed, although current levels of human activity are considered to be low.

3.5.2.4 Cumulative Impacts

Spotted owls and marbled murrelets have been impacted through the logging of old growth and mature forests. The consequence of continued logging activity in their habitat is an issue in many areas. Because all three alternatives are either not likely to harvest timber or will not harvest timber, there would be no added negative impacts on owls and murrelets due to this project. In fact, if harvest activities continue in the area surrounding the project area, all three alternatives will likely provide a benefit to these species by providing mature habitat for them over time.

Alternatives 1 and 2 would be expected to maintain current conditions for all wildlife species while Alternative 3 would be expected to improve current conditions by providing somewhat greater assurance that habitat would be protected. There are no other known cumulative effects, other than those discussed in the two Final EISs (NPS,1995; NPS, 1996b).

3.6 FISHERIES

3.6.1 Affected Environment

There are four types of fish in the Elwha River System:

- anadromous: fish that spawn in rivers or streams but spend a significant portion of their lives in the ocean
- fluvial: fish that spawn in one portion of a river or its tributaries but migrate to other portions of the river
- adfluvial: fish that spawn in rivers or streams but spend a significant portion of their lives in a lake or reservoir
- resident: fish that live their entire lives in the stream or river in which they spawn.

Historically, the Elwha River system contained at least 11 stocks of anadromous and resident trout and salmon (NPS, 1996a). The historical species included winter and summer steelhead, coho salmon, summer/fall chinook salmon, spring chinook salmon, pink salmon, chum salmon, sockeye salmon, cutthroat trout, and the char species of Dolly Varden and bull trout. The present stocks include all of the above stocks except sockeye salmon and possibly spring chinook. Those that have resident forms include rainbow trout, cutthroat trout, bull trout, and Dolly Varden. Additional species found within the Elwha River system and its estuary include resident stocks such as eastern brook trout (introduced), threespine sticklebacks, and sculpins and other anadromous fish including white sturgeon and smelt, and marine species of flounders (NPS, 1996a).

Historically, upwards of 75 miles of stream were accessible to anadromous stocks in the Elwha River. The construction of the Elwha and Glines Canyon dams have restricted the distribution of the anadromous stocks to below the Elwha Dam and reduced both the number of individuals and species present. The dams have also modified the quality and quantity of the habitat both upstream and downstream of the dams. In addition to blocking passage of anadromous fish, the dams and the respective reservoirs have reduced downstream movement of sediment. This has adversely affected spawning habitat quality and altered the condition and site of the estuary. The presence of the reservoirs has also modified flow, temperature, and nutrient conditions in the intervening river reach upstream of Lake Aldwell and below Elwha Dam. This is affecting water quality conditions, which adversely influences resident fish and anadromous fish production below the dam. However, the habitat upstream of Lake Mills remains in near pristine conditions, because it is located within the Olympic National Park.

The Elwha River is the largest producer of steelhead and chinook salmon on the Strait of Juan de Fuca and second to the Dungeness River for coho salmon. Production of other anadromous stocks is low regionally. Nearly all of the chinook salmon, coho salmon, and steelhead production is of hatchery origin.

The resident fishery in the Lake Aldwell region is dominated by rainbow trout. A small number of cutthroat and brook trout are also harvested (Morrill and McHenry, 1995; Mausolf and Sundvick, 1976; Collins, 1983). Bull trout fishing is now prohibited. Lake Aldwell and the adjoining Elwha River in the project area are managed by the state as a quality resident fish system with gear and harvest restrictions.

The aquatic habitat in the project area includes all of Lake Aldwell, about 0.4 mile of the Elwha River below Elwha Dam, about a 0.5 mile reach of river where it enters the lake, and

a 0.3 mile region along the north shore of the lower portion of Indian Creek. The lake area provides rearing habitat for resident fish. The Elwha River portion of this area upstream of the lake is also limited to rearing habitat since much of this region has low velocity because the river is backed up by the lake. The Elwha River region below the dam may include some spawning habitat for anadromous fish but it is limited due to the large size substrate. This has resulted from years of scour during high flows and lack of gravel replacement from upstream. Indian Creek drains Lake Sutherland and flows through an area of second-growth timber and intermittent farmland and marshes. It lacks suitable spawning substrate, and becomes warm during summer months from surface flows from Lake Sutherland (Williams et al., 1975). Therefore, the reach of Indian Creek under the direct influence of management action contains limited habitat for resident trout.

3.6.1.1 Chinook Salmon

While some spring chinook may be present, the current stock is referred to as summer/fall chinook because of the time the fish arrive in the river. The summer/fall chinook arrive in the lower Elwha River from July through September and spawn in medium size gravel. Peak spawning occurs from mid-September through mid-October in mainstem regions. Juveniles emerge in early winter and primarily outmigrate in July and August of their first year (Schroder and Fresh, 1985), while a smaller portion of fish spend over a year in the stream before outmigrating in their second spring. Large numbers of summer/fall chinook are reared in the hatchery and released, averaging about 2,000,000 smolts per year. The WDFW goal is to release 3,850,000 smolts per year. This goal was achieved in 1999 (personal communication, Don Rapelje, WDFW, 1999). The majority of chinook returning to the Elwha River system are of hatchery origin, although substantial numbers do spawn naturally. Escapement has fluctuated around 2,000 fish per year in recent years.

3.6.1.2 Coho Salmon

The majority of coho salmon return to the river from mid-August to early December. Spawning occurs from October to December, with preferred spawning habitat in side channels. Recent habitat improvements to side channels by the Lower Elwha Klallam Tribe resulted in increased spawning by coho salmon in the wild (personal communication, Brian Winter, October 20, 1999). Like chinook salmon, coho salmon emerge from the gravel in early to late winter but all coho juveniles rear for over a year before outmigrating the following spring, mostly from March to mid-June (Wunderlich, 1983). Typically, hatchery releases have been approximately 750,000 smolts annually (personal communication, Larry

Ward, Lower Elwha Klallam Tribe, 1999). Adults returning to the river are primarily hatchery fish, averaging about 2,000 fish per year in the late 1990s (NPS, 1996a).

3.6.1.3 Pink Salmon

Pink salmon are all natural within this river system. Since about 1979, pink salmon numbers have been extremely low. There have been less than 10 since about 1989 (NPS, 1996a). Their arrival and spawning period extends from about July through October. Pink salmon typically seek out and spawn in small gravel, which is limited in the lower river. Rearing time in the river is very limited for this species. Most individuals emerge from the gravel in March to early June and migrate almost immediately to the marine environment, where they may spend up to 2 months in the nearshore and estuarine environment before migrating to deeper water.

3.6.1.4 Chum Salmon

While some attempts have been made at hatchery production prior to 1986, all current fish are wild. However the returning numbers have also been very low for this stock, typically less than 700 fish. Time of return and spawning is similar to coho salmon, with fall and early winter migration and spawning. Chum salmon use small gravel in the limited side channels of the lower river to spawn. Their emergence and outmigration is essentially the same as pink salmon, spending essentially no time rearing in the river and relying on nearshore marine conditions for early rearing.

3.6.1.5 Steelhead

Steelhead are one of the more sought after sport species in the lower river and also supply a major commercial fishery for the Lower Elwha Klallam Tribe. The hatchery program for winter and summer steelhead helps the Elwha River to be the largest producer of steelhead in the Strait of Juan de Fuca. However, some native stocks do exist in the river. Winter run steelhead migrate into the Elwha River from December through early March, while summer run steelhead arrive from late April to September. Summer run steelhead may spend up to 6 months in the river before spawning. Summer run steelhead generally spawn in the winter, while winter run steelhead generally spawn in the late spring. These races utilize a wide range of gravel sizes for spawning, but they primarily spawn in large gravel mainstem areas of the Elwha River. Steelhead have one of the longer rearing periods before migrating out to the ocean, with most spending two winters in the river before leaving in the spring months, primarily April through June.

The Lower Elwha Tribal Fish Hatchery is the primary source of winter steelhead stocking. Approximately 150,000 yearling smolts are released each year (personal communication, Larry Ward, Lower Elwha Tribe, 1999). This stocking has resulted in returns of about 3,100 fish from a release of about 82,000 smolts in some years (NPS, 1996a). The summer run is produced primarily from hatchery releases by WDFW from an off-site hatchery. While the winter run is harvested by in-river public sport and tribal commercial fisheries, the summer run, which is much smaller, is harvested primarily by sport fisheries.

3.6.1.6 Searun and Resident Cutthroat Trout

The presence of both resident and searun cutthroat is low in the Elwha River System. While a few (likely less than 10 per year) searun cutthroat are caught incidentally to other fisheries in the lower river, they are a desirable sport fish in Washington State (NPS, 1996a). They are also rare above Elwha Dam as resident fish, though small numbers were found primarily in Indian Creek, which is a major tributary to Lake Aldwell (Morrill and McHenry, 1995). Additionally, no cutthroat were reported in a creel survey of Lake Mills, Lake Aldwell, and the intervening river (Collins, 1983). Stocking of hatchery fish has been limited to Lake Sutherland, with stocking of about 10,000 resident cutthroat trout per year in the 1980s (NPS, 1996a). Lake Sutherland drains into Lake Aldwell through Indian Creek. Adult spawning migration may occur from July to January with spawning occurring from December to March. Spawning areas are more typically low gradient, small to medium size tributaries (Trotter, 1989), not mainstem large rivers like the Elwha River. Anadromous cutthroat trout rear for several years before outmigrating in March to May to the marine environment, where they typically remain within 30 miles of their stream of origin. Resident cutthroat have several life forms. These may include fish that never leave the stream of origin (resident) and adults that migrate from lakes to streams (adfluvial) to spawn, with juveniles eventually returning to lakes.

3.6.1.7 Dolly Varden/Bull Trout

These species of char were not officially considered as separate species until 1980 (Mongillo, 1993). Due to the difficulty in using diagnostic characteristics for separation, the lack of examination for species separation in most areas, and great similarity in life history in this region, Washington State manages these as one stock. However, bull trout have been listed as Threatened, while Dolly Varden have not. Bull trout are discussed in more detail in Section 3.6.1.9. Generally, these fish are widely distributed but not abundant in the state.

The Elwha River System has both anadromous (all lower river fish are thought to be this form) and non-anadromous (resident, fluvial, and adfluvial) forms of Dolly Varden/bull trout (WDFW, 1998). Twelve of the 13 char collected upstream of Lake Mills were identified as bull trout, the other was a Dolly Varden. No identification to species level for fish collected in other areas (below Lake Mills and below Elwha Dam) has been made (WDFW, 1998). They have been observed in creel collection in the Elwha River below Lake Mills and in Lake Aldwell in 1981 and 1982 (Collins, 1983). They have rarely been captured in the Lower Elwha Tribal hatchery trap, and one or two a year have been observed in the WDFW Elwha River chinook rearing channel (WDFW, 1998). The specific life history of these fish is unknown; however, anadromous forms typically migrate upriver in May to December and spawn in the fall, usually October. Fry emerge in April to mid-May. After rearing 3 to 4 years, they migrate to the ocean in the spring and return to the same stream in the fall, repeating this cycle annually. The non-anadromous form, upstream of Elwha Dam, may have an adfluvial form that undergoes behavior similar to anadromous stocks, returning to the lake annually. Other forms include those that remain in tributaries (resident) and those that migrate from the mainstem Elwha River to the tributaries (fluvial).

3.6.1.8 Other Resident Trout

Resident rainbow trout are the most abundant salmonid upstream of Elwha Dam and are the most abundant game fish in the project area waters. Other resident fish include bull trout/Dolly Varden, cutthroat, and eastern brook trout (a non-native species). Rainbow trout were the most abundant in creel surveys from Lake Mills and the Elwha River (Collins, 1983). However, those from Lake Mills were larger. At that time Collins (1983) concluded fishing pressure was affecting size. Since then, fishing regulations have been changed (selective fishing gear, and reduced catch limit) to improve population structure. Production of fish below Glines Canyon Dam may be affected by the reservoir effects on food supply, habitat, and water quality (NPS, 1996a). Sporadic stocking of hatchery rainbow has occurred in the past in Lake Mills, Lake Aldwell, the Elwha River, and Lake Sutherland, but fish stocking has been discontinued. Currently, the lakes and river are managed as wild fish production without hatchery supplementation. The rainbow trout life history is similar to steelhead. Typically, they spawn in April to June with fry emerging in mid-summer. These non-anadromous fish may also have varied life history with resident, fluvial, or adfluvial forms.

3.6.1.9 Federally Threatened and Proposed Fish Species

The chinook salmon stocks of the Elwha River are considered part of the Puget Sound chinook salmon Ecologically Significant Unit (ESU) that has been listed as Threatened under the ESA (Federal Register Vol. 64, No. 56, Page 14308, March 24, 1999). The Elwha River escapement has a 5 year average of 1,500 fish with one hatchery contributing to these numbers. The National Marine Fisheries Service (NMFS) concluded that the Elwha River stock is undergoing a declining trend and that it is unlikely these runs could be maintained without hatchery support on this system (Myers et al., 1998; Federal Register, March 24, 1999). The lack of access to spawning habitat as a result of dam blockage is considered a major factor in this limitation. The outbreaks of the fish parasite *Dermocystidium salmonis* during low flow and warm water conditions is known to have major effects on spawning adult fish survival in the lower Elwha River. Other limiting factors for this stock include lack of spawning gravel, estuary loss, and loss of large woody debris. The details of the life history of the Elwha River chinook stocks are discussed in Section 3.6.1.1.

The bull trout subpopulations found in the lower Elwha River (below the Elwha Dam) and the upper Elwha River (above the Glines Dam) are part of the Coastal-Puget Sound portion of the bull trout populations listed as Threatened under the ESA (Federal Register Vol. 64, No. 56, Page 14308, March 24, 1999). These subpopulations are 2 of the 35 subpopulations within this region, which extends from the Columbia River mouth north along all coastal drainages and all Puget Sound drainages. The lower Elwha River subpopulation is considered "depressed" by the USFWS, while the upper portion of this subpopulation is considered to have "unknown" status. While many factors influence the survival of bull trout across this range, the main factor noted as affecting the lower river subpopulation is the presence of the dam, blocking access to the upper river (Federal Register, June 10, 1998). The same fish parasite *(Dermocystidium salmonis)* that affects chinook salmon in the late summer may also affect bull trout in the lower river during low flow-high temperature periods. Bull trout, along with all northwest salmonids, are highly sensitive to high temperatures (optimum less than 14°C). Because of this temperature sensitivity, high summer water temperatures in the lower river may also contribute to the depressed state of this subpopulation.

Factors affecting the stocks in the direct project area have not been described. However, the warm water and low gradient in Indian Creek likely limits its use by bull trout. Because these stocks often have adfluvial forms, Lake Aldwell likely does supply habitat for this stock. Food supply and spawning habitat may be affected in the Elwha River upstream of

Lake Aldwell as a result of Glines Canyon Dam affecting natural nutrient and sediment movement downstream. The life history of this species is discussed in Section 3.6.1.7.

3.6.2 Environmental Effects

3.6.2.1 Alternative 1, No Action

Under the No Action Alternative, current conditions affecting fisheries resources will persist. Important fisheries resources within the proposed project area and downstream would continue with their same trends. Activities, including sport and commercial fish harvest, land development, dam operations, habitat conditions that currently influence fisheries resources would remain as they currently are so that no significant effects to fisheries resources would result from maintaining current conditions. Spawning gravel, large wood, and other habitat requirements would remain well below historic levels.

3.6.2.2 Alternative 2, Proposed Action

The proposed action would not substantially change any action that would affect the fisheries resources within or outside of the direct project area. Fishing activity would remain the same and thus there would be no influences on stocks from harvest changes as a direct result of this action. The ability of fisherman to access the resources would not change unless the reservoir is lowered (see 3.9.2.2). Also, potential changes in operation of Elwha Dam will not have marked influence on downstream anadromous fish or resident fish in the vicinity of Lake Aldwell.

One of the actions, as part of this alternative, is to consider managing the operations of the Elwha Dam to support restoration and recovery of fisheries resources. Hydroproject operations can usually only directly influence flow timing, flow amount and, possibly the temperature of water released by selection of discharge route. In this interim condition, no anadromous fish will be present upstream of the project area so operations will have no direct effect of their movement through Lake Aldwell. Changes in fish passage (ladders, trucking, screens) will also not be part of this action. Operation effects are separate from the effects of the reservoir that influence many other factors like sediment and nutrient movement. Therefore, changes in operations of the Elwha Dam are limited to directing flow between the turbines or the surface spillways.

Under Alternative 2 all of the flow could be directed from the turbines to the spillway. Because the turbine intakes are near the surface, the route from which water leaves the reservoir (by surface spill or through turbines) would not affect the temperature within Lake

Aldwell or in the river downstream (see Section 3.2). The Elwha Dam is operated as a run-of-the-river project. Therefore, no changes in flow rate would occur downstream directly from the considered operations of Elwha Dam, unless power production ceases and the reservoir is lowered. Lowering the reservoir 10 to 15 feet would result in a short-term increase in suspended sediment, a loss of benthic, phytoplantain, and zooplantain production, and a loss of lake habitat with a corresponding increase in river plankton and stream plankton habitat.

These potential changes in operations of Elwha Dam will not have a significant effect on fisheries resources either in the anadromous region downstream of the project or those within Lake Aldwell. Flow and temperature at certain times of the year are important factors affecting the fish in the lower Elwha River. For example, temperature in conjunction with flow may influence the fish parasite *(Dermocystidium salmonis)* outbreaks that can be devastating to chinook and, to a lesser degree, other fish. The timing of temperature changes may also influence egg development rate and emergence timing of fish that spawn in the lower river. However, within the range of possible changes in operation of the Elwha Dam, no effects would occur to flow or temperature (see Section 3.2). Therefore, no effects are likely to anadromous fisheries resources downstream from operational changes.

Changing the source (from turbine intake to spillway) of discharge water from the Elwha Dam seems unlikely to affect entrainment rate and survival of resident fish. It is likely that no marked changes in number of resident fish entrainment would occur from potential changes in operation. There may be a slight improvement in survival of entrained fish if they pass through the spillway instead through the turbines. However, the current spillway is very rough and can cause mortality for fish passing by this route. Additionally, entrained fish may find limited usable habitat downstream and may ultimately be lost to the whole system whether they survive passage or not. The net effect is that marked change in number of fish entrained from Lake Aldwell and overall survival of those that are entrained is likely to be small relative to current conditions.

3.6.2.3 Alternative 3

Under Alternative 3, effects to fisheries resources would be nearly the same as Alternative 2, with no significant changes from current conditions. Fishing activities in the project area would likely remain unchanged unless the reservoir is lowered (see 3.9.2.2), including both the small anadromous zone downstream of Elwha Dam and in the Lake Aldwell region. The fishing regulations in the anadromous zone of rivers under NPS jurisdiction in Olympic National Park are usually maintained by the NPS the same as those issued by WDFW in

adjoining river areas (personal communication, Brian Winter, October 20, 1999). The short stretch of river (less than 0.4 mile) that would be under NPS management with this alternative, would therefore not change in harvest regulations from what is currently in place. The Lake Aldwell region is already managed for limited fish harvest and selected gear use. These fishing regulations would likely be maintained under the NPS, so no change in resident fish harvest would occur. No land-disturbing activities would occur from logging or mining under this alternative; however, these activities are not occurring under the current management of the land owner. Therefore, the current protection of stream areas and lake shoreline would be essentially unchanged from current conditions.

3.6.2.4 Cumulative Effects

There would be no cumulative effects other than those discussed in the Implementation EIS (NPS, 1996a and 1996b). None of the actions considered under this project will have any significant cumulative effects on fisheries resources in the Lake Aldwell region or the anadromous region of Elwha River downstream. The current water quality and flow conditions of the lower river that affect listed chinook salmon and proposed bull trout will remain unchanged. The impediments of the dams to passage of anadromous fish upstream, and blockage of sediment movement downstream, will also remain unchanged. Any effects of harvest of anadromous and resident fisheries stocks, including the listed chinook and proposed for listing bull trout, will remain as they are currently. Land disturbing activities that could influence production of fish within the region of Lake Aldwell will not markedly change from what is currently occurring.

3.7 CULTURAL RESOURCES

3.7.1 Affected Environment

Cultural resources include structures, landscapes, traditional cultural properties, ethnographic sites, and archeological sites. These resources represent a continuous occupation of the lower Elwha River area that goes back many centuries. They also demonstrate the importance that the Elwha River has had, and continues to have, in the culture and the economy of the area.

The Elwha River is central to the culture of the Lower Elwha Klallam Tribe. This is shown in the archeological record and in the oral tradition of Lower Elwha Klallam Tribe. Lower Elwha Klallam villages were located adjacent to important fishing stations at Ediz Hook, the mouth of the Elwha River, and at the confluence of Indian Creek and the Elwha River, as well

as in the upper Elwha River valley. Seasonal camps for fishing, hunting, and gathering were located along the river and its tributaries. Trails used by the Lower Elwha Klallam Tribe followed the river and its tributaries into the mountains to reach hunting and berry gathering areas. The river, the fish it supported, and certain locations along the river were central to the cultural life of the Lower Elwha Klallam Tribe. Tribal members were still living at the confluence of Indian Creek and the river when construction began on the Elwha Dam (NPS, 1995). The Lower Elwha Klallam Reservation is located at the mouth of the river. Prior to the construction of the dam, the Elwha River fisheries formed the basis for the Lower Elwha Klallam Tribe's economy. The Lower Elwha Klallam Tribe's right to fish, hunt, and gather materials for subsistence is guaranteed under the Treaty of Point No Point.

The Olympic Power and Development Company, which was formed by Thomas T. Aldwell and George A. Glines, began work on the Elwha Dam in 1910. The original foundation failed in 1912, causing catastrophic flooding downstream. The foundation was rebuilt and both the dam and the powerhouse were completed in 1914. The dam is listed on the National Register of Historic Places. The dam is a part of the family history for some members of the Port Angeles community because members of their family helped to construct the dam.

Despite state laws requiring fish passage, the Elwha Dam did not provide for passage. While the hydroelectric project provided power for consumers in Port Angeles and created jobs, the character of the river and the valley changed radically. The anadromous fishery upon which the Lower Elwha Klallam Tribe's economy was based was severely damaged. A major benefit of the Tribe's treaty rights to fish at "usual and accustomed grounds and stations" was negated. The dam not only blocked fish access to most of the Elwha River and its tributaries but operation of the powerplant also affected fish in the river downstream of the dam through periodic reductions in the flows. Spawning grounds were left without water and fish were stranded away from the river. Also, the loss of the free flowing river greatly harmed the spiritual well-being of the Tribe. The reservoir that developed behind the dam caused tribal members to lose access to sacred sites and at least one Lower Elwha Klallam Tribe settlement site, along with seasonal camps. Also, habitat for many resources was lost, including fish, game, and plants used for food, medicine, and raw materials.

The Elwha River Hydroelectric Powerplant Historic District includes the dam and both spillways, the five penstocks, and the powerhouse. The dam is significant because it is associated with the development of technology for power generation and the organizations that were formed to develop and distribute power. In addition, the Elwha powerplant is an example of a low head hydroelectric system and a rear, early multiple-buttress dam. Other cultural resources considered historically important include homesites.

3.7.2 Environmental Effects

The effects on cultural resources and landscapes from removing or not removing the dam are disclosed in the two Final EISs (NPS, 1995; NPS, 1996b). The effects from Alternatives 1, 2, and 3 are primarily restricted to increased protection of cultural resources under Alternatives 2 and 3 compared with current conditions (Alternative 1) and improved fish production resulting from operating the dam to benefit fisheries (Alternatives 2 and 3) rather than primarily for power production (Alternative 1). Improvements to fish production would have a positive effect on the Lower Elwha Klallam Tribe's treaty right to harvest fish.

3.7.2.1 Cumulative Effects

There are no cumulative effects beyond those disclosed in the two Final EISs (NPS, 1995; NPS, 1996b).

3.8 AIR QUALITY

3.8.1 Affected Environment

Ambient air pollution in the area surrounding the Elwha Dam property is within national, state, and local air quality standards. See NPS (1996a) for a discussion of air quality.

3.8.2 Environmental Effects

None of the proposed alternatives is expected to have any direct, indirect, or cumulative effects on air quality in the project area other than those discussed in the Final EIS (NPS, 1996b).

3.9 RECREATION

3.9.1 Affected Environment

The Elwha River valley has traditionally been used for recreation, timber production, fish harvest, power production, and residential purposes. The portion of river that is inside Olympic National Park is dedicated to park uses such as hiking, fishing, camping, picnicking, and wildlife observation. The lower reach and the portion of the middle reach outside the park experience mixed use, including limited Native American cultural and subsistence uses, boating, and hunting and trapping (NPS, 1996a). The lower Elwha River has an important winter steelhead fishery. Trout fishing is generally rated as very good in the backcountry areas of the upper river (FERC, 1993).

WDFW administers a primitive public access boat ramp on the southwest corner of Lake Aldwell. This site, typically visited once every three weeks by a WDFW maintenance crew, receives low usage with only one bag of garbage removed on each maintenance visit. Lake Aldwell provides limited recreational opportunities because of its relatively small size, cold water temperature, and poor accessibility due to steep shorelines (FERC, 1993).

Annual recreational usage at the Elwha Project has been estimated to range from 3,000 to 4,000 visitors, with peak weekend usage estimated to range from 75 to 100 visitors (James River II, 1988e cited in FERC, 1993).

3.9.1.1 Fishing

The recreational fishery of the Elwha River focuses on resident trout and hatchery-produced winter steelhead. Game fishing on Lake Aldwell is managed by WDFW. Under current regulations, Lake Aldwell is open for game fishing from the last Saturday in April to October 31 each year with a daily trout catch limit of two fish of at least 12 inches. Statewide rules apply to other game fish. Lake Aldwell is not stocked with fish. Rather, it is managed for "quality fishing" of native fish (WDFW, 1999a). The eastern shorelines and the north end of Lake Aldwell provide good fly fishing by trolling or casting from boats.

The 1,061-acre property also includes a short stretch of the Elwha River that extends about one-half mile below the Elwha Dam. Game fishing here is also managed by WDFW. Under current regulations, this stretch of the Elwha River is open for game fishing from June 1 through February 29 with a daily trout catch limit of two fish of at least 14 inches. Statewide rules apply to other game fish. This stretch is open for salmon fishing from October 1 through November 15. Salmon fishing is limited to coho only with a daily limit of 6 fish of at least 12 inches and additional limitations of no more than four adults. Fishing is prohibited from any floating device and fishing is not permitted in the stretch of the river extending 200 feet downstream from the south spillway of the dam (WDFW, 1999b).

Freshwater salmon sport harvest in the Elwha River in 1995 consisted of 250 coho, 6 jack, coho, and 3 pink salmon (WDFW, 1999c). The 1995-1996 steelhead sport catch in the Elwha River consisted of 130 summer and 284 winter steelhead. The 1996-1997 steelhead sport catch comprised 101 summer and 475 winter steelhead (WDFW, 1999c, 1999d).

The Elwha River supported approximately 22,000 hours per year of summer trout fishing in Lake Aldwell and Lake Mills and the intervening stretch of the river in 1981 and 1982. Anglers spent between 8,500 and 9,500 hours fishing at both lakes from July through September of each year (FERC, 1993).

3.9.1.2 Camping

Camping in the Elwha River area occurs at the NPS-operated Elwha and Altaire campgrounds located approximately at RM 11 and RM 12.5, respectively. These two campgrounds, located south of the 1,061-acre property and within the boundaries of the Olympic National Park, received between 5,000 and 8,000 visitors each year from 1990 to 1994 (NPS, 1996a).

Camping opportunities are also available at the privately-owned Elwha Resort and Indian Creek Resort. The Elwha Resort, located immediately south of Lake Aldwell, is a lease operation on part of the 1,061-acre property. Camping typically occurs during the summer months and involves tent and trailer use. This resort also offers some cabin and cottage-type accommodations. A small private RV park is located off Lower Dam Road and Highway 112, north of the 1,061-acre property.

3.9.1.3 Whitewater Boating

The Elwha River between Glines Canyon Dam and Lake Aldwell is used for whitewater kayaking and rafting. The Altaire Campground is the primary put-in site for most whitewater trips. Upper Lake Aldwell is the primary take-out point.

3.9.1.4 Hunting

Hunting for waterfowl, grouse, deer, bear, and cougar is allowed on the property. Elk hunting is also allowed, but few elk are on the northwest side of Highway 101. Most elk are found on the south side of Highway 101. Trapping small furbearers is also a popular activity in the area (WDFW, 1999c).

3.9.1.5 Wildlife Viewing

Wildlife viewing associated with Lake Aldwell and surrounding area include opportunities to see swans over the lake in winter, birds of prey—such as eagles, ospreys, and other hawks—that use the area, and other birds and mammals of interest (WDFW, 1999a).

3.9.2 Environmental Effects

3.9.2.1 Alternative 1, No Action

There would be no change to the existing conditions under this alternative. Recreation activities would remain essentially unchanged under Alternative 1. Hunting, fishing, and wildlife viewing opportunities would not change, and camping and other recreational activities at the Elwha Resort would continue.

3.9.2.2 Alternative 2, Proposed Action

Under Alternative 2, the 1,061-acre property would be managed under the oversight of the NPS but current management activities would remain largely unchanged. Power will continue to be produced, and reservoir levels are expected to remain unchanged. Contingent on funding, NPS would offer to purchase the lease hold rights to the Elwha Resort and it would be closed. If this were to occur it would result in a relatively small loss of currently available camping opportunities. A commercial rafting outfitter that formerly operated out of the Elwha Resort has relocated across the river. Other recreation activities would remain essentially the same as under Alternative 1.

If power production ceases and the spillway gates are opened, the reservoir would be lowered 10 to 15 feet below existing levels. If this drawdown were to occur the WDFW boat ramp may no longer be able to accommodate trailer boats. Under this scenario, WDFW may choose to cease operating the ramp and/or transfer ownership of the ramp to the federal government. Drawdown would reduce the surface area of the lake and the number of resident trout available for lake fishing. There would be some gain in habitat for resident fish in the river and streams above the dam but the overall net change would likely be a reduction in fishing opportunities in the short-term. Lowering the reservoir level 10 to 15 feet would expose old tree stumps, mud, and debris and create a sharp visual contrast with the dense vegetation along the reservoir shorelines. This visual impact may deter some individuals from pursuing recreational opportunities at the lake. Other recreation activities would likely remain unchanged under this option. As with the first option, NPS could offer to purchase the Elwha Resort lease hold rights if funding is available. Long-term recreation effects associated with permanent reservoir drawdown are discussed in the Elwha River Ecosystem Restoration Final Environmental Impact Statement (NPS, 1996b).

3.9.2.3 Alternative 3

The 1,061-acre property would be managed under similar rules and regulations as the Olympic National Park. Hunting would be prohibited on the property. Fishing and wildlife viewing opportunities would be similar to Alternative 2. As in Alternative 2, the Elwha Dam would be managed by the BOR to support fish recovery. Effects would be the same as those described for Alternative 2. Management of the stretch of the river below the dam would likely be consistent with the State's management of waters. Therefore, fishing is not likely to be affected under this alternative.

Camping and other recreational activities at the Elwha Resort would not continue if the lease hold rights to the resort are purchased by the NPS and the resort is closed. This would represent a relatively small loss of currently available camping opportunities. The commercial rafting outfitter that operated out of the Elwha Resort has relocated across the river. Kayaking and rafting would likely continue on the stretch of Elwha River between Glines Canyon Dam and Lake Aldwell. Long-term recreation effects associated with drawdown are discussed in the Elwha River Ecosystem Restoration Final Environmental Impact Statement (NPS, 1996b).

3.9.2.4 Cumulative Effects

No cumulative effects are expected other than those associated with dam removal. These are discussed in NPS 1996a and b.

3.10 SCENIC QUALITY

3.10.1 Affected Environment

The lower Elwha River valley is a modified mosaic landscape composed of mixed land uses—active logging, forest, pasture, rural residential, including the Lower Elwha Reservation (574 aces of tribal land at the mouth of the river), quarries, small commercial enterprises, recreational developments, a fish hatchery, and others. The immediate region surrounding the lower river appears as a mix of forest and rural uses.

Lake Aldwell lies within a deep valley and accounts for about one-quarter or 270 acres of the project lands. A canyon divides the reservoir into two wide reaches. The surrounding lands are forested. Vegetation surrounding the lake is dominated by second growth stands, which occur primarily on areas that have been logged. Land cover on the project lands surrounding the reservoir includes mature conifer forest (44 percent), mixed forest (25 percent), and hardwood forest (17 percent). About 22 acres (3 percent) of the surrounding lands are

developed (FERC, 1993). These lands include the Elwha Resort, which includes a number of cabins. The small grocery store and bar are not open.

The Elwha Dam, approximately 450 feet long at its crest and about 105 feet high, is a major element of the existing visual landscape. The multiple buttress dam, which is on the National Register of Historic Places, contrasts in form and texture with the natural surroundings. Small peripheral buildings of differing architectural styles, materials, and colors exist on both the east and west banks of the reservoir near the dam. The office/maintenance buildings and the two powerhouses are painted white and contrast with the surrounding dark forest and exposed rock colors (FERC, 1993). The weathered concrete and mosses growing in the face of the dam are, however, similar in color to the exposed rock of the canyon wall. In contrast to the large-scale, clean lines, and materials of typical public power projects on the Columbia River, most of the view of the Elwha Dam consists of the powerhouse and auxiliary structures (NPS, 1996a).

3.10.1.1 Scenic Resource Management

The Elwha Dam was not designed to protect or enhance scenic qualities. The Elwha Dam and Lake Aldwell, which have historically been privately owned, are not presently managed for scenic values by public or private programs or regulations (FERC, 1993).

The 1,061-acre property is surrounded by public and private landowners. The Clallam County comprehensive plan, which regulates uses of private lands, does not have policies or programs related specifically to scenic values within the Elwha River watershed (NPS, 1996a). Olympic National Forest lands south of Lake Aldwell are being managed according to the visual quality objective of "partial retention," which requires that changes to the landscape remain visually subordinate to the characteristic features and patterns of that landscape. The Washington Department of Natural Resources (DNR) and the WDFW both manage lands within the viewshed of Lake Aldwell. Much of the land managed by DNR has been logged or is scheduled to be logged in the near future. DNR does not manage public lands to protect aesthetic or scenic values nor do they have policies or programs for scenic protection (NPS, 1996a).

3.10.1.2 Key Viewing Areas

Although Highway 101, one of the primary transportation routes on the Olympic Peninsula, parallels the east side of Lake Aldwell, intervening vegetation and topography prevent direct views of the lake. One exception to this is an informal, undesignated pullout that provides a

broad view of the southern portion of the lake. Otherwise, motorists passing in relatively close proximity are virtually unaware of the reservoir's presence.

Highway 101 crosses the Elwha River immediately above Lake Aldwell but there are no developed viewpoints. A gravel road leads to the WDFW boat ramp on the southwest lakeshore, the only signed public access viewpoint on the lake. The dam complex on the north end of the lake is accessed via an unsigned county road off Highway 112. There are no developed trails on the project lands. Camping facilities are, however, available at the Elwha Resort located on the south end of the lake.

Views of the lake and surrounding area are primarily limited to anglers fishing on the lake and the occasional sightseer visiting the dam complex. An unimproved trail heading west from the dam allows occasional horseback riders views of the lake. A primitive fishing trail and Lower Dam Road provide access to views of the dam structure.

3.10.2 Environmental Effects

3.10.2.1 Alternative 1, No Action

There would be no change to the existing conditions under this alternative. The 1,061 acres, including the Elwha Dam, would continue to be managed and operated under present state and local authorities, laws, regulations, and conditions of general private land uses that have been typical of private land in the area.

The 1,061-acre property would not be managed to specifically to protect scenic or visual values under this alternative, but the property would be managed to conserve natural resources and would essentially remain as it is. The surrounding lands would continue under their existing management. Changes in surrounding areas would occur as logging continues on state and private land or if residential or commercial development takes place on privately-owned land.

3.10.2.2 Alternative 2, Proposed Action

Under Alternative 2, the 1,061 acres would be managed under the oversight of the NPS. If power continues to be produced, current management direction would continue largely unchanged. The aesthetic effects under this alternative would, as a result, be the same as those under Alternative 1. Effects on the surrounding lands would be the same as those described for Alternative 1.

If power were not produced and the spillway gates were not locked open, management for fish recovery might involve increasing the volume and frequency of spill over the dam. The static visual setting presented by the weathered concrete dam face would be replaced with water cascading over the dam during periods of spill. While this change would be evident to people viewing the dam from the powerhouse and auxiliary structures, this temporary change would not be evident from vantage points on the lake or locations accessed via the primitive fishing trail and Lower Dam Road.

The lowering of water levels 10 to 15 feet would expose old tree stumps, mud, and debris and create a sharp visual contrast with the dense vegetation along the reservoir shorelines until this area is revegetated. A short-term increase in water turbidity is anticipated under this scenario. Long-term visual effects associated with permanent reservoir drawdown are discussed in the Elwha River Ecosystem Restoration Final Environmental Impact Statement (NPS, 1996b).

Contingent on funding, NPS would offer to purchase the Elwha Resort lease hold rights under both Alternative 2 options. If the Elwha Resort chose to sell these rights the resort would be closed. This would represent a relatively small loss of currently available camping opportunities. If this were to occur, one or more of the buildings located at the south end of the lake may be removed. This would be a fairly insignificant alteration to the visual landscape unless all of the structures were removed and the area was returned to a more natural rather than a man-made appearance.

3.10.2.3 Alternative 3

Under Alternative 3, the 1,061-acre property would be managed by NPS personnel under applicable NPS regulations and in accordance with the declared policy of Section 1(b) of the Wild and Scenic Rivers Act.

The NPS has not developed a visual resource management system for public lands under its jurisdiction. However, the primary management objective pursued for NPS-controlled lands is the preservation of all significant resources, including the scenery. The NPS organic act states that one of the fundamental purposes of a national park is “to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such a manner and by such means as would leave them unimpaired for the enjoyment of future generations” (NPS, 1996a). Management under these broad guidelines during this interim period would involve little change in scenic quality, except for effects associated with lowering the reservoir and other stages of dam removal.

Effects from managing the dam and reservoir would be the same as those described for Alternative 2. The NPS would offer to buy the lease hold rights to Elwha Resort contingent on funding and it would be closed. If the resort is purchased, one or more of the buildings may be removed, altering the visual landscape. This would, however, be a fairly insignificant alteration to the visual landscape unless all of the existing structures were removed and the area was returned to a more natural rather than a man-made appearance.

3.10.2.4 Cumulative Effects

No cumulative effects are expected, other than those associated with the first stage of dam removal discussed in NPS 1996a and b.

3.11 SOCIOECONOMICS

3.11.1 Affected Environment

Clallam County extends from just east of the city of Sequim westward along the Strait of Juan de Fuca to the most westerly point of land in the continental United States, Cape Flattery, and south to include the town of Forks. Port Angeles is the largest city in the county and the county seat. The county encompasses 1,116,902 acres of land and 595,827 acres of water. The combined area covered by the Olympic National Park and the Olympic National Forest encompasses roughly half of the county (Washington State Employment Security Department, 1999a and 1999b). For much of its length, the Elwha River flows northward within the boundaries of the national park before emptying in the Strait of Juan de Fuca west of Port Angeles. The Elwha Dam and Lake Aldwell are located north of the Olympic National Park boundaries.

Clallam County had a 1998 resident population of 66,700, an increase of 19 percent from 1990 (Washington State Employment Security Department, 1999a and 1999b). This population is about 90 percent Caucasian. Native Americans are the second largest racial group, accounting for 3,255 or about 5 percent of the 1998 population. An estimated 556 Native Americans resided on or near the Lower Elwha Reservation in 1990 (NPS, 1996a). Most of the county's population is concentrated around Port Angeles and Sequim. Port Angeles accounted for about 29 percent of total county population in 1996 (Washington State Employment Security Department, 1999a and 1999b). Total county population is estimated to reach about 67,900 by 2000 and 75,500 by 2010 (Washington State Office of Financial Management, 1999).

Clallam County's economic base has been historically dominated by natural resource based activity. About 75 percent of the county's manufacturing jobs are related to forest products. Employment in the lumber and wood products and paper and allied products sectors has, however, been declining since 1977. In 1995, these sectors employed a total of 1,503 workers. However, about 365 of these jobs were lost with closure of the ITT Rayonier pulp mill in March 1997 (Washington State Employment Security Department, 1999a and 1999b). Commercial fishing and shellfish harvesting have also been important traditional activities in the county. Activity in these sectors has also declined in recent years, primarily due to declining numbers of fish. Other resource-based industries of importance include agriculture and mining (NPS, 1996a).

The Elwha River is currently the largest producer of steelhead and chinook salmon on the Strait of Juan de Fuca and is second only to the Dungeness River for coho. Although salmon and steelhead run sizes in the Elwha River are greatly reduced from pre-dam levels, they are significant contributors to the Strait of Juan de Fuca and Vancouver Island fisheries, with the exception of chum salmon production which is small compared with other strait streams. Nearly all chinook, coho, and steelhead are hatchery-produced (NPS, 1996a). These resources are important to the Lower Elwha Klallam Tribe (see Section 3.7).

The ongoing loss of manufacturing jobs may be partially offset by growth in tourism- or travel-related industries. About 1,100 jobs were generated by the travel industry in 1995. These include jobs in the accommodations, eating and drinking, food stores, retail trade, amusement and recreation, and transportation and related sectors. Annual average wages are, however, significantly lower in travel-related industries than in manufacturing, $17,665 versus $33,574 in 1995 (Washington State Employment Security Department, 1999a and 1999b).

3.11.1.1 Power Production

The Elwha and Glines Canyon dams annually produce an average of 172 gigawatt hours (GWh) of power through the Bonneville Power Administration (BPA)/Port Angeles City Light system. Average annual energy production from Elwha Dam averages about 70 GWh (FERC, 1993). The power generated from both dams supplies the Daishowa mill in Port Angeles and represents about 38 percent of the mill's annual power consumption. The Daishowa mill employs approximately 320 people (NPS, 1996a and 1996b). Costs to operate both the Elwha and Glines Canyon dams averaged between $6 and $10 per megawatt hour or $1 to $1.5 million in 1993 (FERC, 1993). Operating and maintaining the Elwha and

Glines Canyon dams employs approximately 10 people (NPS, 1996a and 1996b). The Elwha Dam is staffed 24 hours per day.

3.11.1.2 County Tax Revenue

Total Clallam County revenues were $37.1 million in 1998. General property taxes accounted for $10.1 million of this total, sales and use tax generated $3.6 million, and intergovernmental revenues provided the remainder (Washington State Auditor's Office, 1999). The County presently collects approximately $267,000 in annual property tax on the 1,061 project acres, including the Elwha Dam.

3.11.1.3 Recreation

Recreation activities in the project area, including fishing, hunting, and wildlife viewing, are managed by WDFW. WDFW also owns and maintains the primitive boat launch on the southwest corner of Lake Aldwell, collects trash, and enforces laws and regulations. The Elwha Resort located on the 1,061-acre property on the south side of Lake Aldwell is privately owned and operated.

3.11.1.4 Social Values

The two Elwha River dams have been a source of controversy since their construction, with local communities divided over the tradeoffs between hydropower and a free-flowing Elwha River. More recent uncertainty surrounding the future of these dams has focused local, regional, and national attention on this issue (NPS, 1996a and 1996b).

Similar controversy surrounded the creation of Olympic National Park in 1938. Creation of the park followed a long and bitter struggle between conservationists and timber interests. Local timber-oriented communities were concerned that future economic opportunities were restricted by creation of the Park. This perspective was also evident at the 1973 wilderness hearings where local development and business groups voiced their opposition to the NPS wilderness proposal. Downturns in the timber industry have focused attention on the tourism value of the Park and this has softened some of the earlier antagonism. However, many local business groups remain opposed to the Park and especially the wilderness policies of the NPS that prohibit commercial development.

3.11.2 Environmental Effects

The following sections address the federal costs and revenues that would be generated under each alternative. These costs and revenues are summarized for each alternative in Table 3-1, located at the end of Section 3.11.2.4.

3.11.2.1 Alternative 1, No Action

There would be no change in management under this alternative. There would be no annual costs or revenues to the federal government under this alternative (Table 3-1).

3.11.2.2 Alternative 2, Proposed Action

Under this alternative, the 1,061 acres would be managed under the oversight of the NPS. Except for dam operations, current management would continue largely unchanged. Emergency services would be provided by state and county authorities, except for wildland fire suppression, which would be provided by the Olympic National Park. There would be no additional federal costs associated with provision of these services because the 1,061 acres would be a relatively small addition to the nearly 1,000,000-acre area already managed by the NPS.

Recreation activities would continue to be managed by WDFW at no cost to the federal government. Contingent on funding, the NPS would offer to purchase lease hold rights to the Elwha Resort. If the resort owner chooses to sell these rights the resort would close. The cost of buying the resort is not known at this time. Recreation activities would remain unchanged unless a change in the reservoir level restricts the use of the boat ramp or the resort closes. Cultural resources would be protected under federal laws and regulations. No additional federal costs associated with cultural resources protection activities are expected, since no development projects are likely under this alternative.

The dam and the powerplant would be operated by the BOR, under NPS oversight. The dam would be managed to support fish recovery but it will continue to produce power unless unforeseen circumstances curtail power production. In order to cover both possibilities, two possible cost and revenue outcomes associated with this alternative are analyzed.

If the dam were managed for power production, annual costs to the federal government under this alternative would be $1,759,300 (Table 3-1). This total includes the cost of managing the dam for power production, a payment in lieu of taxes that would compensate Clallam County for the loss of property taxes associated with the transfer of the 1,061-acre property from private to public ownership. Income from the sale of the power produced by the dam would be $1,575,000, assuming that an average of 70 GWh of power are sold by BPA to the

Daishowa mill at the 1996 average industrial firm rate. Federal expenditure would exceed revenue by about $184,300.

If the dam were not managed for power production, annual costs to the federal government under this alternative would be $1,262,300 (Table 3-1). This lower total reflects the reduced costs associated with managing the dam for fish recovery but not power production. There would be no revenues generated by the project if the dam is not managed to produce power.

There are two possible operation scenarios for dam operation. The first option would involve periodically opening and closing the spillway gates to maintain optimal water flows for fish, whether or not power is produced. The second option would involve locking the spillway gates open and lowering the reservoir 10 to 15 feet below existing levels. Cost estimates for potential gate modifications and safety upgrades have not been completed for either operation scenario. As a result these costs are not included in the "without power production" costs presented in Table 3-1.

Locking the spillway gates open may, however, be the lower cost of the two options. No additional costs associated with this type of operation are anticipated. The area 10 to 15 feet below current reservoir levels would be exposed with the drawdown. No bank stabilization measures are anticipated as a result of drawdown. Dropping the reservoir level 10 to 15 feet is consistent with the first stage of dam removal. Long-term socioeconomic effects associated with permanent reservoir drawdown are discussed in the NPS 1996a and 1996b.

Additional costs to the federal government would include a one-time cost of approximately $3,000 for a natural resource survey of the property.

3.11.2.3 Alternative 3

Under this alternative, the 1,061-acre property would be managed by NPS personnel under applicable NPS regulations and in accordance with the declared policy of Section 1(b) of the Wild and Scenic Rivers Act. Laws would be jointly enforced by state and county authorities and NPS personnel. Emergency services, such as fire protection and search and rescue, would be provided by NPS personnel, in cooperation with state and county authorities. The costs associated with these services are presented in Table 3-1. As in Alternative 2, there would be no additional federal costs associated with provision of wildland fire suppression services because the 1,061 acres would be a relatively small addition to the area already managed by NPS.

Recreation use would be managed by NPS personnel. The WDFW would continue to operate the boat ramp and collect trash at no cost to the federal government, unless the boat ramp

becomes unusable due to drawdown or it is transferred to the federal government. Contingent on funding, the NPS would offer to purchase the lease hold rights to the Elwha Resort. If the owner chooses to sell, the resort would be closed. The likely cost of the resort is not known at this time.

Education and interpretive programs would be implemented within available funding constraints. Cultural resources would be protected under federal laws and regulations. No additional federal costs associated with cultural resources protection activities are expected, since no development projects are likely under this alternative.

The dam and the powerplant would be operated by the BOR, under NPS oversight. The dam would be managed to support fish recovery. Effects from dam management would be the same as under Alternative 2.

Controversy has surrounded the existence and management of the Olympic National Park since its creation. Local business interests in particular remain opposed to the park and the wilderness policies of the NPS that prohibit commercial development. Some groups may consider NPS interim management of the 1,061-acre property as an expansion of the park. This might lead to resentment by groups and individuals who feel that development and recreation opportunities are unreasonably restricted by NPS management policies. Such groups or individuals might resent NPS employees enforcing laws and restricting their activities. Hunting would no longer be permitted and commercial development would be prohibited. Treaty rights would be protected.

Annual costs to the federal government under Alternative 3 would be $1,401,800. This total includes the cost of managing the dam for fish recovery but not power production, payment in lieu of taxes, law enforcement costs, natural resource management costs, and education and interpretation program costs. Initial law enforcement and natural resource management costs of $46,000 and $14,000 (including costs for a natural resource survey of the property) would be incurred in the first year. Adding these costs to the annual total results in a first year cost of $1,458,800. The dam would not be managed for power production and, therefore, there would be no revenue generated under this alternative. Therefore, federal costs would exceed revenues by $1,401,800 a year ($1,458,800 for the first year).

3.11.2.4 Cumulative Effects

No cumulative effects are expected other than those associated with dam removal. These are discussed in NPS 1996a and b.

Table 3-1. Cost Comparison by Alternative (Dollars)

Alternative	Alt. 1	Alt. 2, with Power Production	Alt. 2, without Power Production	Alt. 3 with Power Production	Alt. 3 without Power Production
Expenditure					
Dam Operation and Maintenance[1/]	N/A	1,500,000	1,000,000	1,500,000	1,000,000
Payment in Lieu of Taxes	0	259,300	259,300	259,300	259,300
Law Enforcement[2/]	0	0	0	88,000	88,000
Natural Resource Management	0	0[3/]	0[3/]	4,500[4/]	4,500[4/]
Education & Interpretation Programs	0	0	0	50,000	50,000
Total[5/]	0	1,759,300	1,259,300	1,901,800	1,401,800
Revenue					
Electricity Sale[6/]	0	1,575,000	0	1,575,000	0
Net Federal Revenue/ Expenditure	0	-184,300	-1,259,300	-326,800	-1,401,800

1/ The "Without Power Production" option in Alternatives 2 and 3 does not include costs associated with gate modifications and safety upgrades.

2/ Initial costs of $46,000 would be incurred in the first year. Total first year law enforcement costs would be $134,000.

3/ Initial costs of $3,000 would be incurred in the first year.

4/ Initial costs of $14,000 would be incurred in the first year. Total first year natural resource management costs would be $18,500.

5/ Does not include the cost to purchase the lease hold rights to the Elwha Resort. This may occur under Alternatives 2 and 3, but is contingent on funding and the owner's willingness to sell.

6/ This assumes that an average of 70 gigawatt hours (GWh) of power are sold by BPA to the Daishowa mill at the 1996 average industrial firm rate of 2.25 cents per kilowatt hour (kWh) (BPA, 1999)

Note: Payments to the WDFW by the dam owner (currently amounting to $160,000 per year) would cease upon federal/acquisition of the projects. The WDFW is investigating alternatives of funding. Cost reimbursement may be available if the project produces power at a rate that provides a positive revenue stream. This would reduce net federal revenues shown for Alternative 2.

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